

ABSTRACT

A direct vessel injection-type pressurized light water reactor (DVI-PLWR), in which an emergency core cooling water (ECC) is directly injected into a downcomer of a reactor vessel, is disclosed. In order to reduce the ratio of ECC bypass from the downcomer to a broken area of a cold leg in the case of a cold leg guillotine break (CLGB), such as a double-ended guillotine break (DEGB), a plurality of corrugations, having a V-shaped cross-section, are vertically arranged around each of the inner surface of a pressure vessel and the outer surface of a core barrel at regular intervals, with a vertical groove formed between two neighboring corrugations. The grooves phase-separate the ECC from a high-speed lateral flow of fluid running in the downcomer, and the separated ECC stagnates in the form of vortexes in the grooves, prior to flowing down to the lower section of the downcomer due to gravity. The DVI-PLWR thus reduces the ratio of ECC bypass, and a large amount of ECC reaches the reactor core in the case of a large break loss-of-cooling water accident (LBLOCA) caused by DEGB. It is thus possible to limit an increase in the maximum cladding temperature of fuel rods, and to prevent the reactor core from being reheated at the late reflood phase after the DEGB-caused LBLOCA, so that the desired thermal hydraulic safety of the DVI-PLWR is secured.